Assessment methodology of Active Pedestrian Safety Systems: an estimation of safety impact

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1. Introduction

Devoid of any protection, pedestrians are highly vulnerable to road accidents against a vehicle. To enhance their protection, new safety-based technologies have been introduced in the vehicle market. These on-board systems are developed to prevent crashes from occurring or reduce their severity by reducing the impact speed. Several methods assessing these systems have been presented (e.g. Lindman et al. 2010). This research is focusing on assessing the benefit of Active Pedestrian Safety Systems (APSS's) for pedestrian injury mitigation. Researchers have established a relationship between impact severity and variations in speed impact (Rosén et al., 2010; Anderson et al., 2012). This project is examining the effect of speed reduction on variations in impact conditions.

Outlines of the assessment method are presented here illustrated with one example.

2. Methods

The first step consists of gathering a sample of real vehicle/pedestrian crashes provided by in-depth crash investigation. A considerable level of details is required to reconstruct numerically the pre-crash sequence including trajectories of the vehicle and pedestrian prior to the collision and the eventual obstacles. Each crash is modelled by representing the vehicle and pedestrian involved and the road environment. An APSS is then virtually represented by the parameters of the sensor and actuator.

Once modelling has been set up, all the required components of each sub-model (crash environment, vehicle, pedestrian, and sensor and actuator technology) are implemented through a computational simulation and so interacting in a virtual environment identical to the real world crash scenario. This batch simulation provides a set of data displaying a new impact speed distribution. This distribution is estimated according to the actuation of the emergency braking manoeuvre.

The last step is to estimate change in injury outcome using the HIC. These changes are calculated through the use of multi-body system (MBS) software, MADYMO®. The real accident is firstly simulated in order to obtain the actual risk. Finally, by adding the effect of the emergency braking manoeuvre, the simulation enables to find out if the risk is reduced.

3. Results and Discussion

To show the possibilities of this assessment method, an accident case has been selected.

Figure 1 Scheme illustrating the crash scenario

In the original configuration of the crash, the HIC was 1645.6 for an impact speed of 37 km/h. With an APSS fitted in the vehicle, the impact speed is reduced to 8.9 km/h and the pedestrian head doesn't hit any part of the vehicle and hit the ground resulting in a very low HIC value of 28.2.

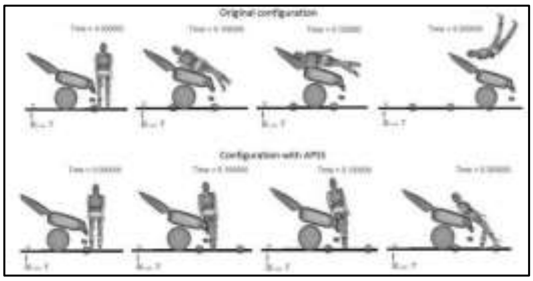

Figure 2 Crash simulation with and without APSS

4. Conclusions

In this research, a formalized assessment methodology has been presented and illustrated with one case to forecast the safety benefits of APSS. This method is based on confronting these systems to real accident configurations through computational simulations. The safety impacts of these systems is then estimated by comparing injury outcome with and without the system enabled for the crash set.

References

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